Section 2.3

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"A short study break—five, ten, twenty minutes to check in on Facebook, respond to a few emails, check sports scores—is the most effective technique learning scientists know of to help you solve a problem when you're stuck."

- Benedict Carey, *How We Learn: The Surprising Truth About When, Where, and Why It Happens*

(1) Identify for which of the following p-values you would reject the null hypothesis at a significance level of $\alpha = 5\%$.

A p-value $= 0.078$

B p-value $= 0.045$

C p-value $= 0.5$

D All of the above

E A and B but not C

(2) Identify for which of the following significance levels you would FAIL TO REJECT the null hypothesis if your p-value is 0.064.

A $\alpha = 0.05$

B $\alpha = 0.10$

C $\alpha = 7\%$

D All of the above

E B and C but not A

Buzz's errors (Type I)

In Example 1.1, we looked at a study to investigate whether dolphins could communicate. In doing so, we tested whether Buzz, one of the dolphins, could push the correct button more than 50% of the time in the long run. **(3)** Describe what a type I error would be in this study.

A We find strong evidence that Buzz is not guessing, but he is guessing.

B We have little to no evidence that Buzz is guessing, but he is guessing.

C We find strong evidence that Buzz is guessing, but he actually is not guessing.

D We find evidence that Buzz pushes the correct button more than 50% of the time, but he, in fact, pushes it much less than 50%.

Buzz's errors (Type II)

In Example 1.1, we looked at a study to investigate whether dolphins could communicate. In doing so, we tested whether Buzz, one of the dolphins, could push the correct button more than 50% of the time in the long run. **(4)** Describe what a type II error would be in this study.

A We find strong evidence that Buzz is not guessing, but he is guessing.

B We find that guessing is a plausible reason for Buzz's choices, but he actually is not guessing.

C We reject that Buzz has a 50% chance of pushing the correct button, when, in fact, he does have a 50% chance.

D We have good evidence that Buzz pushes the correct button exactly 50% of the time, but he, in fact, pushes it much less than 50%.

(5) The significance level α determines the probability of making a Type I error. Errors are bad. So, why don't we always set alpha to be extremely small, such as 0.0001?

A It's a matter of convention that we almost always use 5%.

B Setting it too small would also decrease the probability of a Type II error too low to be safe.

C Setting it that small will increase the type II error rate leading to many missed opportunities.

D It is not mathematically possible to set the significance level to anything below 0.01.

FlyHigh Airlines is considering the cancellation of service for their weekday flights from Green Bay to Phoenix due to low ticket sales. They have determined that if these flights average 70% occupancy (at least 70% of all seats on these flights are full), then the flights should be continued, but if the average flight is significantly below 70% occupancy ($\alpha = 0.05$), then the flight should be cancelled.

(6) If they end up canceling the flights, even though they do average 70% occupancy in reality, what kind of error have they made?

A Type I, and I am confident.

B Type I, I think.

C Type II, and I am confident.

D Type II, I think.

Jimmy has been eating lunch at Jimmy John's and believes he is spending too much money. He decides he can afford no more than \$10 for lunch. He runs a test of $H_0 : \mu = 10$ against $H_a : \mu > 10$ at the $\alpha = 0.10$ level, where μ represents the mean amount of money he spends on lunch. If the results are significant ($p < 0.10$) he will switch to Subway for lunch, otherwise he will continue to eat at Jimmy John's.

(7) If he continues to eat at Jimmy John's even though his long run average lunch expense is above \$10, what kind of error has he made?

A Type I, and I am confident.

B Type I, I think.

C Type II, and I am confident.

D Type II, I think.

- Confidence interval
- Confidence level
- Plausible values for the parameter